50th Northeast Regional Stock Assessment Workshop (SAW)

Stock Assessment Review Committee (SARC) Meeting
Monkfish (*Lophius americanus*)
Sea Scallop (*Placopecten magellanicus*)
Pollock (*Pollachius virens*)

Woods Hole Laboratory
Northeast Fisheries Science Center
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Executive Summary

- The 50th Stock Assessment Review Committee (SARC 50) met at the Northeast Fisheries Science Center (NEFSC), in Woods Hole, Massachusetts, from June 1 – 5, 2010 to review Northeast regional benchmark stock assessments for monkfish, sea scallop, and pollock.

- The objective of the Panel was to conduct a detailed peer review of the results of the three stock assessments to determine whether they were adequate to serve as a basis for developing fishery management advice. Each assessment had multiple terms of reference (ToRs) that had to be addressed by the Panel.

- This report is my independent review of each assessment to determine whether the data are adequate and used properly, the analyses and models are carried out properly, and the conclusions are correct and/or reasonable to serve as a basis for developing fishery management advice. I have also provided research recommendations and/or points of clarification for each assessment.

- **Monkfish**: Of the three assessments, the greatest concerns were with monkfish. Uncertainties in landings, discards, commercial length frequencies, aging methods, life history, growth, and natural mortality are propagated through the assessment model and lead to greater uncertainties in estimates of stock size, recruitment, fishing mortality, biological reference points, and stock projections. The compounding nature of these uncertainties implies increased risk. In as much as possible, these uncertainties were addressed in the terms of reference and in my opinion the current assessment is adequate in serving as the basis for developing management advice.

- **Sea scallop**: Of the three assessments, the scallop assessment was most strongly supported by the available data. A thorough, rigorous, and logical assessment was presented, including numerous refinements to the assessment model. Each of the terms of reference was met and in my opinion the current assessment is more than adequate in serving as the basis for developing management advice.

- **Pollock**: Of the three assessments, the pollock assessment was the most radically changed as a new assessment model was used. The new model (ASAP) was accepted as a significant improvement over the previously used AIM model. A clear and thorough assessment was presented from which it was obvious that considerable model exploration had been done. All but one of the terms of reference was met and in my opinion the current assessment is more than adequate in serving as the basis for developing management advice.

Background

The SARC 50 Panel met at the NEFSC, in Woods Hole, Massachusetts, from June 1 – 5, 2010 to review Northeast regional benchmark stock assessments for monkfish, sea scallop, and pollock.

The Panel consisted of five members, two from the New England Fisheries Management Council's Scientific and Statistical Committee (SSC), and three external reviewers, including myself, under contract to the Center for Independent Experts (CIE). Bob O'Boyle (SSC) chaired the Panel; the other panelists included Patrick Sullivan (SSC), Michael Bell (CIE) and Kurtis Trzcinski (CIE). In addition, there were two advisory representatives to the Panel: Jim Weinberg and Paul Rago, both from the NEFSC.

The ToRs for the SARC 50 review, the proposed meeting agenda, and all background and assessment documents were posted and available for review on the NEFSC web site by May 19, 2010.

A conference call was held on May 19, 2010. Participants included the five Panel members plus Jim Weinberg and Paul Rago. The purpose of the conference call was to review the meeting agenda and to assign responsibilities to each of the Panel members. I was assigned the lead role for the monkfish assessment; similarly Michael Bell was assigned sea scallop, and Kurtis Trzcinski and Patrick Sullivan were jointly assigned pollock. Each panelist was asked to focus and lead the discussion on his respective assessment but not at the exclusion of reviewing the other assessments. Each panelist was also assigned responsibility for drafting the section of the SARC Summary Report for his respective assessment.

The objective of the Panel was to conduct a detailed peer review of the results of the three stock assessments to determine whether they were adequate to serve as a basis for developing fishery management advice. Each assessment had multiple ToRs that had to be addressed by the Panel.

During the review meeting, Anne Richards and Paul Nitsche presented the monkfish assessment, Dvora Hart presented the sea scallop assessment, and Elizabeth Brooks presented the pollock assessment. All presenters were from the NEFSC. The meeting was also attended by numerous scientific staff from the NEFSC and by members of the general public representing different groups within the fishery.

Each assessment was allocated approximately seven hours during the meeting, two hours for the assessment presentation, followed by a forty-five minute discussion. Two hours were allocated to revisit and further discuss the assessment, and two and a half hours were available to review and edit the Assessment Summary Report.

Special thanks are extended to Jim Weinberg and his assistant, Andrea Toran. Jim and Andrea coordinated the meeting and ensured that the Panel was well cared for during the week. Jim also provided clarification of the ToRs throughout the meeting and ensured that the Panel focused their discussion on addressing each ToR. Paul Rago was very helpful as an advisor to the Panel. On numerous occasions he provided sage advice based upon his thorough knowledge of each of the three assessed species. The Chair, Bob O'Boyle, did an excellent job in focusing the Panel on key issues in each assessment and ensuring that the allocated time was used efficiently and wisely. Rapporteurs were assigned for each of the assessments. Their attention to detail was very valuable in helping the Panel in writing the SARC Summary Report.

Description of the Individual Reviewer's Role in the Review Activities

The terms of reference for each of the three assessed species, the proposed meeting agenda, background documents, and assessment reports were posted by Jim Weinberg on the NEFSC web site at least two weeks prior to the SARC 50 meeting, within the schedule required by the CIE Statement of Work (SoW). I read and reviewed all documents prior to the meeting, with particular emphasis on the monkfish assessment and background documentation.

During the SARC meeting, detailed presentations were given by the lead scientists for each of the respective assessment Working Groups. These were then followed by question, discussion, and review periods. The restricted timeline of the meeting precluded any major re-analyses or revisions to the assessments. I participated in the peer review of each assessment, discussing its results, conclusions, and recommendations.

Before the meeting concluded, the Panel reviewed each of the ToRs for the assessments and summarized its conclusions (in bullet form). Subsequent to the meeting, each panelist drafted his respective section of the SARC Summary Report, based upon the conclusions of the Panel. I completed the monkfish section and submitted it to the Chair, within the assigned deadline. The Chair edited the report and circulated it to the Panel for final review. The SARC Summary Report was then finalized by the Chair and submitted to the SAW Chair.

Summary of Findings

As per the SoW, I will review each assessment separately to determine whether the data are adequate and used properly, the analyses and models are carried out properly, and the conclusions are correct and/or reasonable to serve as a basis for developing fishery management advice.

I will provide an independent review of each ToR and explain why I believe it was or was not completed successfully. I will provide details from the respective assessment reports on information included in each ToR, but only in the context of how I concluded if the ToR was met. My primary focus will be on issues of concern, sources of uncertainty, and recommendations for future research.

This section of the report will deal specifically with each ToR; a summary for each assessment will be provided in the “Conclusions and Recommendations” section of the report.

A. Monkfish

1. Characterize the commercial catch including landings, effort, LPUE and discards. Describe the uncertainty in these sources of data.

   I concur with the Panel that this ToR was met. However, the quality of data available to the Southern Demersal Working Group (SDWG) is poor, at best. This is particularly true of historical data for which there are few if any apparent remedies. Recent data are generally of a higher quality and should be more reliable for future assessments.

   Data from the commercial fishery have multiple uncertainties. Landings data prior to 1990 are uncertain and there are unreported landings that cannot be quantified. Length frequencies are poorly estimated and data are not available for part of the assessment period. Discard estimates vary widely and are also not available for part of the assessment period. There are markets for body parts only and only those body parts are landed; there are uncertainties in the conversion to whole weight. Although not restricted to the commercial fishery, uncertainties in the aging method for monkfish have been identified as a major problem.

   The Statistical Catch at Length (SCALE) model, used in this assessment, relies heavily on length frequency data, from the commercial fishery and from surveys. The time period for the model commences in 1980 and yet there are no fishery length frequency samples prior to 1989. Sampling in most years since 1989 has been adequate for estimation on a half-year basis only. If SCALE is to be used in the future, sampling of length frequencies from the fishery needs to be improved.

   Discard estimates are not available prior to 1989 and discard estimates since then vary widely between management areas and gear types. Discard estimates from 1989 – 1991 are used to estimate discards from 1980 – 1989. There was information presented at the meeting to suggest that discard rates may have been higher in the 1980's, prior to the development of the fishery. If so, this is not accounted for in the catch data and requires further evaluation, possibly through discussions with fishers and the fishing industry.

Until the late 1990's, total landings were dominated with landings of monkfish tails. Landings of monkfish tails still occur in both management areas. In addition, there are markets for cheeks, belly flaps, livers, and whole gutted fish. Conversion factors are used to determine live weight from the landed weight of tails and that of head-on gutted fish. Given the uncertainties in these conversions, consideration should be given, if feasible, to requiring landings of whole fish only.

Catch per unit effort (CPUE) is not used in the SCALE model as monkfish are generally only a bycatch in the groundfish trawl fishery. However, given that >35% of overall landings currently come from directed gillnet fisheries, consideration should be given to examining gillnet CPUE as a potential index.

Uncertainty in the aging method for monkfish is a major issue for this assessment. The SCALE model assumes linear growth. If ages are underestimated, then the assumption of linear growth may not be valid. Issues regarding aging are the major impediment to improving the assessment of monkfish and must be resolved.

2. Report results of 2009 cooperative monkfish survey and describe sources of uncertainty in the data and results.

I concur with the Panel that this ToR was met. Results and uncertainties from the 2009 cooperative monkfish survey were well described. However, the SDWG tended to dismiss the survey results and did not fully evaluate its use in the assessment.

Three cooperative surveys have been conducted (2001, 2004, and 2009). These surveys are beneficial as they utilize commercial vessels that are more capable of catching monkfish than are the NEFSC surveys. The surveys also have the potential to sample greater depths than the NEFSC surveys, where monkfish are known to occur. The SDWG concluded that between and within survey comparisons are difficult due to differing gear efficiencies. Abundance estimates from the surveys were not used in the SCALE model, as the model could not track fluctuations in survey trends.

Paul Rago presented an analysis during the SARC 50 meeting that illustrated the value of these surveys. In his analysis, estimates of population uncertainty are bootstrapped on a survey basis and the computed uncertainty is used to estimate biomass. The SDWG should pursue this analysis further, as abundance estimates from these surveys can provide a means to evaluate SCALE model results.

One vessel (*Mary K*) has participated in all three of the cooperative surveys and in each case has surveyed the Southern Management Area (SMA). Presumably, the efficiency of this vessel to catch monkfish is well established. If so, abundance estimates should be re-examined as inter survey results for this vessel may be more informative.

The SDWG has suggested that the need for future cooperative surveys is diminished due to the increased capability of the *Bigelow* to catch monkfish. It may be premature to eliminate cooperative surveys as there is only a single point in the *Bigelow* time series. Cooperative surveys should be continued for the foreseeable future and greater emphasis should be given to sampling waters greater than 300 m. This goal has not been achieved in previous surveys; however, collaboration with the fishing industry is probably the best way to determine the proportion of monkfish in depths greater than those surveyed by the NEFSC.

3. Characterize other survey data that are being used in the assessment (e.g., regional indices of abundance, recruitment, length data, state surveys). Describe the uncertainty in these sources of data.

I concur with the Panel that this ToR was met. The SDWG identified all documented surveys that may provide indices of abundance and has described the uncertainties in these data sources.

It is reassuring that the *Bigelow* has the capability to catch more monkfish than the *Albatross*, seven times by number, and eight times by weight. However, this must be tempered by the fact that previous surveys caught so few monkfish, that the calibration experiments were conducted in one year only, and that no corrections were made for season (spring vs. fall). This highlights the importance of developing a time series for the *Bigelow* only.

It is not reassuring that survey length distributions have become increasing truncated over time. This is especially of concern in recent years when survey catch rates (and commercial landings) are low. One has to question whether many larger and older fish exist.

The SDWG reviewed the results of the Maine / New Hampshire (ME/NH) spring and fall surveys since 2000 and concluded that these indices show similar trends to those from the NEFSC surveys. The ME/NH fall survey index is included in the final formulation of the SCALE model. However, it is not clear why the ME/NH spring survey index is not included; this requires further clarification.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and characterize the uncertainty of those estimates.

I concur with the Panel that this ToR was met. However, uncertainties in estimates of fishing mortality, recruitment, and population biomass bring into question whether the current assessment is adequate to serve as a basis for developing fishery management advice.

The SCALE model was accepted by the Data Poor Stocks Working Group (DPSWG) in 2007 as the most suitable of several modelling approaches for monkfish. The

SDWG has used SCALE again for this assessment, with minor modifications, even though most of the uncertainties identified in 2007 still exist. This is difficult to reconcile given that this is a benchmark assessment and is supposed to represent advancements since the last assessment.

The final formulation of SCALE exhibits strong retrospective patterns, especially for the Northern Management Area (NMA). The SDWG indicated that the retrospective pattern was due to the model not being able to track a strong recruitment pulse in the NMA. However, it did not provide a thorough investigation of potential hypotheses for why the model was not able to track the recruitment pulse. This brought into question the model results for the SMA. If a strong recruitment pulse had occurred there, would the model have exhibited a similar retrospective pattern? There is a serious concern; it suggests that results are being driven by a model that does not fit the data.

There was considerable discussion whether adjustments should be made to account for the retrospective pattern. The Panel decided not to adjust the abundance estimates from the final SCALE formulation. I tend to disagree; given all of the model uncertainties and associated risks, the adjusted abundance estimates would have provided a more precautionary view of the stock. It would not have changed the perception of stock status but it would have provided current abundance estimates more similar to those provided by the Rago analysis.

The Panel concluded that growth and mortality dynamics are not being captured in the current model which assumes linear growth. If growth is not linear, then the current model, as formulated, would be invalid. There are data from tagging experiments which suggest that growth rate slows with increasing fish size. This requires further evaluation. It also reverts back to the earlier discussion on the uncertainty of the aging method for monkfish. Until this is reconciled, it will be difficult to confirm a growth model for monkfish.

There were also concerns regarding the estimate of natural mortality (M=0.30) used in the SCALE model. Although the SDWG indicated that no new information existed to change M, it suggests that M may have been overestimated in the model as monkfish may live longer. This requires a thorough investigation.

5. Update or redefine biological reference points (BRPs; estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, and $F_{MSY;}$ and estimates of their uncertainty). Comment on the scientific adequacy of existing and redefined BRPs.

   I concur with the Panel that this ToR was met. Overfishing reference points were updated and biomass reference points were re-defined.

   In theory, the re-defined Biological Reference Points (BRPs) are an improvement as they are based on long-term biomass corresponding to F_{MSY}. In reality, given all of the uncertainties related to the results of the SCALE model, it is difficult to conclude if the re-defined BRPs are more scientifically adequate than existing ones.

6. Evaluate stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 5).

   I concur with the Panel that this ToR was met. Stock status was evaluated with respect to existing BRPs, and with respect to re-defined BRPs calculated from abundance estimates that were both unadjusted and adjusted for retrospective patterns. In all cases, monkfish in both the NMA and SMA are not overfished and overfishing is not occurring.

   The evaluation of stock status is only as good as the abundance estimates and BRPs from which it is derived. In this assessment, the uncertainties surrounding these estimates are large. There is also some evidence from recent retrospective patterns that this evaluation may be overly positive and that caution should therefore be exercised.

7. Evaluate monkfish diet composition data and its implications for population level consumption by monkfish.

   I concur with the Panel that this ToR was met. The inclusion of the impacts of the assessed species on other species within the ecosystem is a valuable addition to a single species assessment.

   The analysis highlights that monkfish is an important piscovore and has the potential to be a dominant piscovore within the ecosystem.

   I agree with the Panel's recommendation that it would be beneficial to know if population impacts are occurring on monkfish due to predation by other species.

8. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs).
   a. Provide numerical short-term projections (through 2016). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions to examine important sources of uncertainty in the assessment.
   b. Comment on which projections seem most realistic, taking into consideration uncertainties in the assessment.
   c. Describe this stock's vulnerability to becoming overfished, and how this could affect the choice of ABC.

   I concur with the Panel that this ToR was met.

   Projections were made to 2016 using AGEPRO, assuming F in 2010 equal to the estimated F in 2009 from SCALE, fishing at $F_{threshold}$, and at proposed ACTs and ABCs with stochastic long-term recruitment. Projections indicate that monkfish in the NMA are vulnerable to overfishing or becoming overfished during this period if total catches approach the proposed Acceptable Biological Catch (ABC).

Given all of the uncertainties in the data sources, life history, and the SCALE model, the SDWG wisely decided to provide projections using a single set of assumptions. To do otherwise would have placed greater credence on the projections than they deserve. The projections are probably not realistic and high levels of uncertainty in the projections translate into high levels of risk in using the projections.

9. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in recent SARC reviewed assessments and review panel reports. Identify new research recommendations.

   I concur with the Panel that this ToR was met. The WG provided a list of approximately 30 research recommendation, dating back to 2002. In each case, it indicated the status of the recommendation. It also indicated which recommendations had been completed and/or should be deleted from the list.

   My greatest concern is the lack of progress on most of the recommendations generated from the 2007 assessment. In particular, numerous recommendations relating to the SCALE model are not completed with the reason being that the model is not currently configured to do so. Given that this is a benchmark assessment, greater consideration should have been given to ensure that the current model addresses the concerns of the previous assessment. This may have been a function of the time available to the SDWG to complete the assessment. However, if the SCALE model is to be used in future, reconfiguration of the model is necessary.

   The Panel identified several key areas for future research. I have also identified several research recommendations. If SCALE is to be used in the future, sampling of length frequencies from the fishery needs to be improved. Discard rates during the 1980’s need further evaluation through discussions with the fishing industry. Given the uncertainties in conversions from landed weight to live weight for some body part fisheries, consideration should be given to requiring landings of whole fish only. Consideration should be given to examining gillnet CPUE as a potential index. Issues regarding aging are the major impediment to improving the assessment of monkfish and must be resolved. Cooperative survey data should be analyzed further, as abundance estimates from these surveys can provide a means to evaluate SCALE model results. Abundance estimates from the *Mary K* should be re-analyzed as inter survey results for this vessel may be informative. Cooperative surveys should be continued for the foreseeable future and greater emphasis should be given to sampling waters greater than 300 m. A thorough investigation of potential hypotheses for retrospective patterns in SCALE is required. This should include a re-examination of growth and mortality dynamics, as they are not being captured in the current model.

B. Sea scallop

1. Characterize the commercial catch including landings, effort, LPUE and discards. Describe the uncertainty in these sources of data.

    I concur with the Panel that this ToR was met.

    Mean annual landings since 2002 (26,000 mt meats) are approximately double their long-term average, due to the recruitment of the very large 2001 year class in the Mid Atlantic Bight (MAB). This large year class did not occur on Georges Bank (GB). Historically, landings have been greater from GB; however, in recent years, increased landings have occurred primarily in the MAB. Total effort since 2005 has remained relatively stable with some shifts between regions. Landings per unit effort (LPUE) increased considerably between 1999 and 2003; this has been attributed to management measures which led to stock recovery. Further increases in LPUE in the MAB in recent years have been attributed to strong recruitment.

    Discarding can occur when scallops are high-graded or are too small to be economically profitable to shuck. It has been suggested that discard rates increase with strong recruitment events and that there have been lower discards since 2005 due to the use of an increased ring size on scallop dredges. Discard ratios have been recorded by observers aboard commercial vessels since 1992. However, the assessment time series begins in 1975 and it is not clear if or how discards rates were calculated from 1975 – 1991. Total discard mortality, including mortality on deck and when returned to the water, has been estimated in previous assessments to be 20%. The same assumption is made in this assessment although discard mortality during the summer in the MAB may be higher due to higher water and deck temperatures. The estimation of discard rates prior to 1992 needs clarification and the estimation of discard mortality requires further evaluation.

2. Characterize the survey data that are being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, length data, etc.). Describe the uncertainty in these sources of data. Document the transition between the survey vessels and their calibration. If other survey data are used in the assessment, describe those data as they relate to the current assessment (Exclude consideration of future survey designs and methods).

    I concur with the Panel that this ToR was met.

    Four surveys are used in the current assessment, the NEFSC unlined dredge survey (1975 – 1978), the NEFSC lined dredge survey (1975 – 2009), the School for Marine Sciences Technology (SMAST) large video camera survey (2003 – 2009), and the NEFSC winter bottom trawl survey (1992 – 2007). The inclusion of rock excluder chains in 2004 has been tested and variance calculations have been made to account for the uncertainty in the adjustment factor. Given the nature of scallop dredges, the relatively sessile nature of scallops, and consistent survey methodology, it is not surprising that the uncertainty of the NEFSC survey estimates is small.

The NEFSC survey has been conducted by a combination of vessels from 1975 to 2007, including the *Albatross*, *Oregon*, *Chapman*, and *Tradition*. In 2008 and 2009, the survey was conducted from the *Hugh Sharp*. With the exception of adjusting for tow path length, no significant differences in catch rates were found between vessels. Modifications to the dredge in 2009 are considered to be slight and a downward adjustment of 5% in catch rates is not considered to be significant. Clarification on the determination of this adjustment is warranted.

A HabCam towed digital camera system was used to analyze the efficiency of the NEFSC survey dredge during tows in 2007 – 2009. It indicated that the dredge had an efficiency of ~0.44 in sandy areas and ~0.38 in areas of gravel/cobble/rock substrate, both of which are lower than for commercial vessels. A mean dredge efficiency of 0.41 is used in this assessment, with an assumed CV=0.15. If practical, consideration should be given to using the calculated efficiencies and applying them on a tow by tow basis dependent upon substrate type.

A video survey has been conducted by the School for Marine Sciences and Technology (SMAST) since 2003. This survey utilizes a systematic sampling pattern and includes both GB and the MAB. Counts and shell height measurements are estimated by two video cameras, one “large” and one “small”. Results from the small camera were used in the previous assessment (2007); in this assessment, results from the large camera are used. It is not clear why this change was made.

3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and characterize the uncertainty of those estimates.

I concur with the Panel that this ToR was met. The Invertebrate Working Group (IWG) provided a very thorough analysis. Of 14 modifications made since the last assessment, it was noted that fishery meat weight adjustments based on estimated seasonal anomalies and the seasonal distribution of landings probably had the greatest impact.

As in 2007, a Catch at Size Analysis (CASA) is used as the primary assessment model; GB and MAB are modeled separately. The model is highly dependent upon several parameters including the shell height to meat weight relationship, age and growth, and natural mortality. Considerable effort was made to characterize these, especially growth increments. The growth model was adequately validated and changes to estimates of M were clearly described and defined. In general, a thorough analysis was provided.

CASA models growth using a stochastic growth matrix, estimated using shell growth increment data. The model time series is 1975 - 2009, compared to 1982 – 2009 in the last assessment. Three surveys are used in the current assessment for both trends and shell heights, the NEFSC unlined dredge survey (1975 – 1978), the NEFSC lined dredge survey (1975 – 2009) and the SMAST large video camera survey (2003 – 2009). Only scallops larger than 40 mm are used in tuning the model.

The relationship of meat weight to shell height is depth dependent. As the mean depth of scallops varies from year to year, the same number of scallops may have a different biomass. This creates a source of uncertainty as it is not incorporated in the CASA model.

Commercial shell heights data are obtained from port samples for the period from 1975 to 1984 and from at sea observer samples from 1992 – 2009. It is not clear how shell height data are calculated for the intervening period. Further clarification is warranted.

CASA runs for GB and the MAB show moderate retrospective patterns, with MAB being worse than GB. This may be due to the reduction in the estimate of the 2001 year class and the steep decrease in the 2009 SMAST density estimate. Several analyses were conducted to determine impacts on retrospective patterns for the MAB. It was concluded that the model probably does not account for higher mortality of smaller scallops belonging to larger year classes. The retrospective pattern was also related to the unresolved conflicting signals between the 2009 SMAST density estimate, which showed a sharp decline, and the NEFSC survey index, which showed an increasing trend. The retrospective pattern was not adjusted as it represents the movement of the 2001 year class through the population. The retrospective pattern did suggest some cause for concern in projections, if a strong year class exists. This may be the case for the MAB as the 2008 year class is estimated to be large; it is less of a concern for GB.

4. Update or redefine biological reference points (BRPs; estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, and $F_{MSY;}$ and estimates of their uncertainty). Comment on the scientific adequacy of existing and redefined BRPs.

I concur with the Panel that this ToR was met.

In the previous assessment, per recruit reference points were estimated from the CASA model. F_{MAX} and B_{MAX} were used as proxies for F_{MSY} and B_{MSY}. F_{MAX} is the fishing mortality rate for fully recruited scallops that generates maximum yield-per-recruit. B_{MAX} is defined as the product of the biomass per recruit at $F=F_{MAX}$ and median numbers of recruits. These reference points were updated for information purposes, using this year's CASA model.

Reference points and their uncertainty were redefined in this assessment using a Stochastic Yield Model (SYM). The SYM uses Monte-Carlo simulations to take into account uncertainties in BRPs due to uncertainties in parameter estimates, such as the yield per recruit and stock recruit relationships. This is an innovative approach which was well received and accepted by the Panel. It clearly illustrates the uncertainty as it provides a broad distribution of F_{MSY} and B_{MSY} estimates, where normally only point estimates are given.

5. Evaluate stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 4).

   I concur with the Panel that this ToR was met.

   Regardless of what biomass target is used, i.e. the existing BRP from CASA, the updated BRP from CASA, or the BRP from SYM, the sea scallop fishery is not overfished in 2009.

   Overfishing is occurring if the previous threshold from CASA or the updated threshold from CASA is used. However, overfishing is not occurring if the SYM overfishing definition is used, although the probability that overfishing is occurring is marginally below 50%.

   It should be noted that the region, especially the MAB, is experiencing an unprecedented period of high productivity. It is not known if this can be sustained and if not, how long the condition may last.

6. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs).
   a. Provide numerical short-term projections (through 2014). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions to examine important sources of uncertainty in the assessment.
   b. Comment on which projections seem most realistic, taking into consideration uncertainties in the assessment.
   c. Describe this stock's vulnerability to becoming overfished, and how this could affect the choice of ABC.

   I concur with the Panel that this ToR was met.

   Example projections to 2014 were made using the Scallop Area Management Simulator (SAMS), a length and area structured forecasting method that quantifies risk of overfishing and loss of yield at specified fishing mortalities. The model is spatially explicit and allows for differences among regions in recruitment, growth, initial size structure, management approach, and other factors. Projections were made assuming status quo management with varying initial conditions, natural mortality, and recruitment. Versions of this model have been used to aid management decisions since 1999; the Panel concurred with its use in this assessment.

   There was considerable discussion regarding the selection of a "common currency" to describe measures of fishing mortality (F), given differing selection regimes and consideration was given to several options that could be used for sea scallops. The

Panel concluded that this should be part of a broader discussion and planning exercise for more than sea scallops.

Based upon their life history, sea scallops should not be vulnerable to being overfished, as they mature at an early age and have a high reproductive potential. The risk of being overfished is negligible under status quo management and current environmental regime, which is highly productive especially in the MAB. However, as previously indicated, it is not known if this unprecedented high productivity can be sustained and if not, how long the condition may last. The risk of overfishing is high, which is not surprising as the fishery is close to harvesting at MSY; therefore, caution is advised.

7. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in recent SARC reviewed assessments and review panel reports. Identify new research recommendations.

    I concur with the Panel that this ToR was met. The IWG identified 11 research recommendations from the 2007 assessment and reported on the status of the recommendations. It also identified a further 11 recommendations developed during this assessment.

    The Panel noted that several recommendations from the 2007 assessment had not been addressed as they were not considered of high priority. The Panel was very impressed with changes made by the IWG to improve this year's assessment.

    The Panel identified several areas for future research including estimation and inclusion of discard mortality rates, research on productivity changes in the MAB and GB, and research on reasons for retrospective patterns especially in the MAB.

    I have one further research recommendation: if practical, consideration should be given to using the calculated efficiencies from the HabCam analysis and applying them on a tow by tow basis dependent upon substrate type. Clarification is also required on several points, including: how discards rates are calculated from 1975 – 1991, how a downward adjustment of 5% in catch rates by the *Hugh Sharp* is determined, why results from the SMAST large camera are used in this assessment, and how commercial shell heights data are derived for the period from 1985 – 1991.

C. Pollock

1. Characterize the commercial and recreational catch including landings, effort, LPUE and discards. Describe the uncertainty in these sources of data, including consideration of stock definition.

    I concur with the Panel that this ToR was met.

    Trawl and gillnet fisheries contribute nearly equally to commercial landings in recent years. Recent increases in landings may reflect increased targeting of pollock. Sampling of commercial landings has been good since the early 1980's and catch-at-age data are available back to 1970. Estimates of recreational catch begin in 1981 and the Northern Demersal Working Group (NDWG) assumed negligible recreational catch prior to then. Recreational catches generally average 10% or less of commercial landings except from 2000 – 2004, when recreational catch accounted for up to 24% of the total.

    Discards from the commercial fishery have been estimated since 1989. Discards prior to 1989 are assumed to be negligible. Some discarding of smaller fish may have occurred prior to 1989 and therefore, the catch may be underestimated. In so much as possible, this should be investigated further. It is assumed that discarding occurs in the recreational fishery as pollock are not as desirable as other species. However, it is not clear from the Assessment Report how recreational discard rates are calculated. Although recreational landings represent a small percentage of total landings, the estimated discard rate is often high and discards can be greater than landings. It is therefore important that estimates of recreational discards be well estimated and the method of estimation be fully described.

    The NDWG did not use commercial CPUE in the assessment model as trends in CPUE can be confounded due to changes in management regulations over time.

    There was a lengthy discussion during the meeting regarding stock identification. The NDWG decided to assess pollock in waters within U.S. jurisdiction. This reflects the U.S. management unit but not necessarily the distribution of pollock. Tagging data suggest that pollock in U.S. waters and on the western Scotian Shelf (in Canadian waters) can be considered a unit stock based upon high levels of connectivity. Much of the U.S. catch comes from the central Gulf of Maine near the U.S./Canadian boundary. There are concerns that U.S. catches that straddle the boundary might include pollock caught in Canadian waters, resulting in an inflation of perceived U.S. catch, and a decrease in estimated biomass in the U.S. management unit. This remains a major source of uncertainty in this assessment. The Panel recognized the complexity of trans-boundary stocks and while joint management may not be possible at this time, collaborative research (e.g. systematic tagging studies) may help in characterizing the nature of this stock and its movements.

2. Characterize the survey data that are being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, age-length data, etc.). Describe the uncertainty in these sources of data, including consideration of stock definition.

    I concur with the Panel that this ToR was met.

    The NDWG evaluated several surveys as stock size indicators in exploratory assessment analyses, including the NEFSC spring, fall, summer and larval surveys, the ME/NH inshore surveys, and the MA spring inshore survey. The only survey that was excluded in exploratory analyses was the MADMF inshore fall survey as it caught too few pollock.

    The NDWG decided not to adjust survey data for changes in survey systems, given small sample sizes and imprecise estimates from calibrations. This decision was made despite the fact that a change in trawl doors in 1985 resulted in significant conversion factors for both number and weight in the NEFSC surveys. This results in a source of uncertainty that should be further evaluated.

    It is also somewhat disturbing that a calibration coefficient could not be calculated when the NEFSC changed survey vessels from the *Albatross* to the *Bigelow* in 2009. Pollock catches are too low to derive a reliable conversion factor and the comparison is driven by one value. This suggests that the *Bigelow* may not be as efficient as the *Albatross* in catching pollock, as it uses a slower towing speed and fish may avoid the trawl. This has future implications for the NMFSC time series as there may be reduced sampling effectiveness.

    There is some evidence that the NEFSC surveys and commercial fleets cannot catch large, older pollock. The current assessment model describes these fish as “cryptic biomass” that may represent a substantial portion of the population. Consideration should be given to designing a monitoring survey and/or tagging experiment to confirm the presence or absence of these fish.

3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and characterize the uncertainty of those estimates.

    I concur with the Panel that this ToR was met.

    Pollock have been assessed using an Index Method (AIM) since 2000. AIM used the NEFSC fall survey index and commercial catch, but assumed no age structure. It was not designed for sophisticated projections and performed poorly in recent projections to determine annual catch limits. The SSC rejected the index-based assessment as a basis for catch advice in 2009.

    The NDWG used an Age Structured Assessment Program (ASAP) in this assessment. The model was run with catch at age data from 1970 – 2009 for two fleets, commercial and recreational. The WG reasoned that ASAP was an improvement due to its ability to provide a framework for the evaluation of input parameters. The model also allowed for changes in fishery selectivity, and inclusion of age structure. The Panel concurred with this approach.

The NDWG completed considerable exploratory analyses to validate the model. Sensitivity analyses were run including the NEFSC summer, NEFSC larval, ME/NH spring and fall, and the MA spring surveys. The NDWG concluded that these surveys were not adding any signal and excluded them from the model. The NEFSC spring and fall survey indices were included in the base model. Based upon discussion during the meeting, further sensitivity analyses were conducted to examine the impacts of doubling the CV on commercial catch data from 1970 – 1985, of reducing U.S. and Canadian landings in boundary areas by half from 1970 – 1985, and of assuming full selectivity for age 6 to 9+. The WG also compared the results from ASAP with a formulation using a Statistical Catch at Age (SCAA) model, and provided a biomass estimation analysis from the NEFSC survey data to bound reasonable abundance estimates. The Panel concluded that the ASAP model formulation had been well explored and justified by the NDWG.

Not withstanding the efforts of the NDWG, considerable assessment uncertainties exist. The Panel was most concerned with the evidence of “cryptic biomass”. Assuming dome shaped selectivity, the model produces biomass at older ages that are neither observed in the fishery nor in the surveys. Up to 50% of the biomass may be unaccounted for. This is more disturbing as the fishery is targeting older fish yet older fish are not being caught. It is somewhat comforting that biomass status does not change when survey selectivity is assumed to be fully recruited and not dome-shaped, although B_{MSY} and MSY are scaled downward.

It is difficult to resolve selectivity on older fish. Fish at age 8 are considered fully selected and yet fish age 9+ are only marginally selected. The rationale for a drop in survey selectivity from age 8 to 9+ is based upon the survey’s inability to catch larger, faster Pollock; this is not unreasonable but requires confirmation. There also appears to be an inconsistency as selectivity was more flat-topped in the 1970’s when older fish were caught; this requires further exploration.

Selectivity blocks were chosen to minimize retrospective patterns. The WG concluded that the retrospective pattern is small relative to other groundfish assessments in northeast U.S. waters. The Panel recommended further exploratory analyses to determine if retrospective patterns may be related to “cryptic biomass” and selectivity assumptions.

The Panel was pleased to see the comparison between ASAP and SCAA model formulations but was disappointed that there was insufficient time to explore the SCAA model more closely. The SCAA model provided similar historical trends in spawning biomass to ASAP. However, the scale of biomass estimates over time was larger than from the SCAA model. The Panel recommended further analyses to consider the impact of alternative weightings.

4. Update or redefine biological reference points (BRPs; estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, and $F_{MSY;}$ and estimates of their uncertainty). Comment on the scientific adequacy of existing and redefined BRPs.

   I concur with the Panel that this ToR was met.

   Previous BRPs were derived from the results of AIM. As previously discussed, AIM included the NEFSC fall survey index only, and commercial catch with no age structure. The SSC rejected AIM as a basis for catch advice in 2009.

   BRPs were redefined in this assessment based upon the results of ASAP. F_{MSY} is approximated as the fishing mortality that is expected to conserve 40% of maximum spawning potential. It is expressed as the average F experienced at ages 5 – 7 and is calculated assuming average vectors from 2005 – 2009 for SSB weights at age, catch weights at age, maturity at age, and selectivity at age. Stochastic projections were made using AGEPRO to determine the SSB and yield corresponding to $F_{40\%}$. B_{TARGET} is defined as the median value of SSB_{MSY}, and $B_{THRESHOLD}$ is defined as one half of B_{TARGET}. The Panel noted that although BRPs are heavily dependent upon selectivity assumptions, there is a solid scientific basis for using this approach.

5. Evaluate stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 4).

   I concur with the Panel that this ToR was met.

   The most recent update of AIM indicated that the stock was overfished and overfishing was occurring in 2008. However, as previously noted, AIM cannot capture changes in fishery selectivity as it doesn't incorporate ages.

   Estimates of $F_{40\%\ 5\text{-}7}$ and B_{TARGET} from the ASAP model provide a different perception of stock status as they indicate that overfishing is not occurring and the stock is not overfished in 2009, assuming dome-shaped survey selectivity. If survey selectivity is assumed to be flat-topped, stock status would not change; overfishing would not be occurring and the stock would not be overfished in 2009. However, B_{MSY} would change considerably (from 91,000 mt to 58,000 mt) and MSY would change as well (from 16,200 mt to 11,200 mt).

6. Evaluate pollock diet composition data and its implications for population level consumption by pollock.

   I concur with the Panel that this ToR was met. The inclusion of the impacts of the assessed species on other species within the ecosystem is a valuable addition to a single species assessment.

   The analysis highlights that pollock is an ecologically important piscovore but has never been a dominant piscovore.

I agree with the Panel's recommendation that it would be beneficial to know if population impacts are occurring on pollock due to predation by other species. The Panel also recommended that the consequences of the presence or absence of "cryptic biomass" on ecosystem processes should be explored.

7. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the ToRs).

    a. Provide numerical short-term projections (through 2017). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions to examine important sources of uncertainty in the assessment.
    b. Comment on which projections seem most realistic, taking into consideration uncertainties in the assessment.
    c. For a range of candidate ABC scenarios, compute probabilities of rebuilding the stock by 2017.
    d. Describe this stock's vulnerability to becoming overfished, and how this could affect the choice of ABC.

I concur with the Panel that this ToR was met.

Projections through 2017 were made for the purpose of setting Acceptable Biological catches (ABCs) under three scenarios: $F = F_{40\%}$, $F = 0.75 * F_{40\%}$, and $F_{status\text{-}quo}$.

Projections are based upon density independent recruitment assuming dome-shaped selectivity. The Panel developed the following decision table to show the consequences if this assumption is wrong:

Assumption	**Correct**	**Incorrect**
Domed survey selectivity	Low risk	*High risk*
Flat survey selectivity	Low risk	Low risk

The Panel recommended that the NDWG explores the consequences of each scenario, given that an alternate assumption is correct.

Based upon life history, pollock are at risk to being overfished. Spawning aggregations may make segments of the population more vulnerable to fishing and there is evidence of the depletion of local spawning components. In the context of projections, vulnerability to overfishing and to being overfished is highly dependent upon the assumption of density independent recruitment and dome-shaped selectivity.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in recent SARC reviewed assessments and review panel reports. Identify new research recommendations.

   This ToR was not met. The NDWG provided recommendations based upon formulation of the current assessment. However, it did not provide any information on the status of previous recommendations.

   The Panel focused on two areas for future research. To determine if "cryptic biomass" exists, the Panel recommended several possibilities, including cooperative industry-based surveys, systematic tagging experiments, and/or the use of cameras on NEFSC trawls. To address concerns regarding stock definition, the Panel recommended systematic tagging experiments, otolith chemistry analysis, and/or an analysis of consequences of different stock structure hypotheses on management decisions.

   I have three further research recommendations: catch may be underestimated as discarding of smaller fish may have occurred prior to 1989; this requires further investigation. The NDWG decided not to adjust survey data for changes in survey systems, even though a change in trawl doors in 1985 resulted in significant conversion factors; this also requires further investigation. There also appears to be an inconsistency as selectivity was more flat-topped in the 1970's when older fish were caught; this requires further investigation. Clarification is also required on one point, i.e. how discards rates were estimated for the recreational fishery.

Conclusions and Recommendations

As per the terms of reference for each assessment, recommendations have already been discussed under the Summary of Findings section of this report. This section will deal with conclusions for each assessment and recommendations for the NMFS and SARC review processes.

Monkfish

Of the three assessments, the Panel had its greatest concern with monkfish, to the point of almost rejecting the current assessment. As a benchmark assessment, the SDWG was not bound by past assessment models and could have made any changes that it saw fit. The SCALE model was used for the first time in 2007 and was fraught with multiple uncertainties, many of which were identified as areas for future research. The SCALE model was used again in this assessment, with only minor modifications. Most of the identified uncertainties were not thoroughly addressed. An analysis was presented during the meeting that partly assuaged the Panel's concerns. It indicated that current abundance from the 2009 cooperative survey approximated the retrospective-adjusted estimate from the SCALE model. The Panel ultimately accepted the current assessment but expressed serious concerns regarding high levels of uncertainty throughout the assessment. The independent abundance estimate from the cooperative survey factored greatly in my acceptance of the assessment.

Whereas the model indicates increasing abundance, there is no evidence of an increasing trend in any of the indices. The lack of coherence between trends in the indices and trends in the model is a major cause for concern.

Abundance in the SMA shows similar trends and is of similar magnitude between this assessment and the assessment in 2007. However, recent abundance in the NMA, estimated from this assessment, is much lower than from the assessment in 2007. The difference between areas is difficult to understand, given the minor adjustments between assessments; this is another cause for concern.

Landings in recent years have been substantially reduced and yet this has not been followed by an expected expansion of the length distribution in the fishery or in surveys. This causes concern as it suggests that older monkfish may not exist.

The aging methodology for monkfish must be addressed and resolved before assessments can improve. There is evidence that the current growth model and/or estimation of natural mortality may be wrong. An age-based assessment, concurrent with an improved index from the *Bigelow*, should help to address some of the serious issues surrounding the current assessment of monkfish.

Sea scallop

The Panel saw no reason to consider rejection of the sea scallop assessment and I concur with this decision. To the contrary, of the three assessments, the sea scallop assessment was most strongly supported by the available data. The IWG provided a thorough, rigorous, and logical assessment, including numerous refinements to the CASA model.

The IWG focused strongly on variance estimation throughout the assessment, reducing the reliance on point estimates and better illustrating uncertainties. Innovative approaches were used to deal with the uncertainty in the estimation of BRPs which incorporated the assessment of risk in fishery management decisions.

Although a relatively strong retrospective pattern existed in recent years, the Panel accepted the assessment without adjustments as there is a good rationale for the retrospective pattern and there is good coherence between the surveys and model.

Mechanisms to explain the unprecedented high levels of productivity, especially in the MAB, were not provided. This is a potential cause for concern as it is not known if high levels of productivity are the result of environmental factors that may not be sustainable or due to increased recruitment based upon high biomass levels.

Pollock

The pollock assessment was the most radically changed of the three assessments as the NDWG provided a new assessment model. The Panel accepted the ASAP as a significant improvement over the previously used AIM model and I concur with this decision. The NDWG presented a clear and thorough assessment from which it was obvious that considerable model exploration had been done.

The definition of stock structure was not truly addressed. The NDWG chose to assess pollock within U.S. jurisdictional waters as this matched the U.S. management area. Tagging data indicate that pollock move between Canadian and U.S. waters. By ignoring the trans-boundary nature of the stock, it increases the level of uncertainty and risk for assessments both in Canada and the U.S. There appears to be little interest in conducting a joint assessment even though a large discrepancy in biomass may exist between Canadian and U.S. assessments. The opportunity for a joint assessment is reduced as there is no formal agreement on trans-boundary assessments between the two countries.

There were also concerns regarding a substantial “cryptic biomass” produced by the assessment model, i.e. older pollock that are not caught in either the commercial fishery or research surveys. It is possible that these fish exist; however, this has not yet been supported by empirical evidence. If these fish do not exist, the current estimate of abundance would be reduced substantially. In either case, the uncertainty has implications for fishery management decisions.

NMFS and SARC Review Process

The SARC review process has evolved greatly since my first involvement in 2002. In SARC 32 (2002), five stocks were assessed and the Panel included twelve members, including four assessment scientists from the NEFSC. In SARC 41 (2005); three stocks were assessed and the Panel included four members (including the Chair), all contracted by the CIE. In the current review (SARC 50), three stocks were assessed and the Panel included five members (including the Chair), three from the CIE, and two from the SSC.

The SARC review process is highly structured, well organized, and open, and it provides an independent review of the assessed stocks. SARC 50 provided some improvements to SARC 41 as the Panel had one extra member and two members were experienced with the SSC process. However, time lines were still very tight and it was difficult to provide a thorough review of three stocks within the allocated time.

In this regard, the review process could be improved by having an independent observer at the Working Group meeting where the assessment is done. This individual would be a member of the SARC Panel and provide the Panel with more detailed knowledge of the assessment. In its current format, the SARC Panel is the last review step in accepting or rejecting an assessment. This responsibility is normally assigned to three independent reviewers who do not have detailed knowledge of the assessment nuances, and then have less than ten hours (presentation, review, and discussion) to effect this decision. The process could be strengthened by having one more member per stock, i.e. the independent observer, to aid in the decision process.

I am happy to see that for at least one species (pollock), the Working Group met first with fishers and the industry to gather information and to gain their insights. It is also positive that monkfish fishers were represented at the SARC meeting by assessment experts from the Monkfish Defense Fund. I have expressed concerns in previous SARC reviews about the lack of participation by fishers in the assessment process. Improvements can still be made. Assessment working groups, in general, have a reluctance to fully utilize results of industry-based surveys. The importance of the monkfish cooperative surveys was highlighted in the current meeting as results from the surveys helped ensure that the assessment was accepted. There is also a recommendation to explore the existence of older pollock through industry-based surveys. Such pollock surveys may also become more important if the *Bigelow* catches fewer pollock. Industry-based surveys in general should be encouraged as most, if not all, assessments can benefit from additional information.

Appendix 1. Bibliography of Materials Provided for Review

Monkfish background documents

A1. Northeast Data Poor Stocks Working Group, 2007. *Monkfish Assessment Report for 2007.* Northeast Fisheries Science Center Reference Document 07-21.

A2. Northeast Fisheries Science Center, 2010. *Cooperative Monkfish Surveys.* Unpublished background document.

A3. Northeast Data Poor Stocks Working Group, 2007. *Monkfish Assessment Summary for 2007.* Northeast Fisheries Science Center Reference Document 07-13.

A4. Northeast Fisheries Science Center, 2009. *Goosefish Bigelow-Albatross Calibration Factor Analyses.* Unpublished background document.

A5. Haring, P. & Maguire, J-J., 2008. The monkfish fishery and its management in the northeastern USA. *ICES Journal of Marine Science*, **65**, 1370–1379.

A6. Richards, A., Nitschke, P., Cadrin, S., Rago, P. & Maguire, J-J., 2007. Population assessment of monkfish (*Lophius americanus*) in the northeastern USA. *ICES CM 2007/K:15*.

A7. Johnson, A., Richards, A., Place, A. & Nguluwe, B., 2010. *The use of DNA markers to evaluate US fishery management areas and effective population size of monkfish, Lophius Americanus.* Unpublished background document.

A8. Richards, R.A., Nitschke, P.C. & Sosebee, K.A., 2008. Population biology of monkfish *Lophius americanus*. *ICES Journal of Marine Science*, **65**, 1291–1305.

A9. Sherwood, G. & Grabowski, J., 2010. *Critical diet and habitat shifts in New England monkfish (Lophius americanus): insights from stable isotopes and relation to biological condition.* Unpublished background document.

A10. Sherwood, G., Grabowski, J., Tallack, S., Stephens, N., Platz, T. & Caldwell, T., 2008. *A tagging study to assess monkfish (Lophius americanus) movements and stock structure in the northeastern United States.* 2007 Monkfish Research Set Aside Program, Final Report. Gulf of Maine Research Institute.

A11. Rago, P.J., Weinberg, J.R. & Weidman, C., 2006. A spatial model to estimate gear efficiency and animal density from depletion experiments. *Canadian Journal of Fisheries and Aquatic Sciences*, **63**, 2377-2388.

Monkfish working papers

WP1. Southern Demersal Working Group, 2010. *A. Monkfish (Goosefish) Stock Assessment for 2010.* 50th Northeast Stock Assessment Workshop, Assessment Report.

WP1-Appendices. Southern Demersal Working Group, 2010. *Appendices to the Monkfish Assessment Report.* 50th Northeast Stock Assessment Workshop, Appendices to Assessment Report.

WP2. Southern Demersal Working Group, 2010. *A. Monkfish Assessment Summary for 2010.* 50th Northeast Stock Assessment Workshop, Assessment Summary Report.

Sea Scallop background documents

B1. Northeast Fisheries Science Center, 2007. *Sea Scallop Assessment Summary for 2007.* pp. 24-37 in: *45th Northeast Regional Stock Assessment Workshop (45th SAW): 45th SAW Assessment Summary Report.* Northeast Fisheries Science Center Reference Document 07-11.

B2. Northeast Fisheries Science Center, 2007. *Assessment of Atlantic Sea Scallops.* pp. 139-370 in: *45th Northeast Regional Stock Assessment Workshop (45th SAW): 45th SAW Assessment Report.* Northeast Fisheries Science Center Reference Document 07-16.

B3. Northeast Fisheries Science Center, 2004. *Sea Scallop Assessment Summary for 2004.* pp. 14-16 in: *39th Northeast Regional Stock Assessment Workshop (39th SAW): Assessment Summary Report.* Northeast Fisheries Science Center Reference Document 04-10a.

B4. Northeast Fisheries Science Center, 2004. *Sea Scallop Assessment Summary for 2004.* pp. 87-211 in: *39th Northeast Regional Stock Assessment Workshop (39th SAW): Assessment Report.* Northeast Fisheries Science Center Reference Document 04-10b.

B5. Hart, D.R., 2001. Individual-based yield-per-recruit analysis, with an application to the Atlantic sea scallop, *Placopecten magellanicus*. *Canadian Journal of Fisheries and Aquatic Sciences*, **58**, 2351-2358.

B6. Hart, D.R., 2001. Yield- and biomass-per-recruit analysis for rotational fisheries, with an application to the Atlantic sea scallop (*Placopecten magellanicus*). *Fishery Bulletin*, **101**, 44-57.

B7. Hart, D.R. & Chute, A.S., 2009. Verification of Atlantic sea scallop (*Placopecten magellanicus*) shell growth rings by tracking cohorts in fishery closed areas. *Canadian Journal of Fisheries and Aquatic Sciences*, **66**, 751-758.

B8. Hart, D.R. & Chute, A.S., 2009. Estimating von Bertalanffy growth parameters from growth increment data using a linear mixed-effects model, with an application to the sea scallop *Placopecten magellanicus*. *ICES Journal of Marine Science*, **66**, 2165–2175.

B9. Hart, D.R. & Rago, P.J., 2006. Long-term dynamics of U.S. Atlantic sea scallop *Placopecten magellanicus* populations. *North American Journal of Fisheries Management*, **26**, 490–501.

B10. Jacobsen, L.D., Hart, D., Stokesbury, K.D.E., Jaffarian, T., Allard, M.A., Marino II, M.C., Chute, A., Nogueira, J.I., Harris, B.P. & Rago, P., 2010. *Fishery Bulletin*, **108**, 233-247.

Sea Scallop working papers

WP1. Invertebrate Subcommittee, 2010. *B. Atlantic Sea Scallop Stock Assessment for 2010.* 50th Northeast Stock Assessment Workshop, Assessment Report.

WP1-Appendices. Invertebrate Subcommittee, 2010. *Appendices to the Sea Scallop Assessment Report for 2010.* 50th Northeast Stock Assessment Workshop, Appendices to Assessment Report.

WP2. Invertebrate Subcommittee, 2010. *B. Sea Scallop Assessment Summary for 2010.* 50th Northeast Stock Assessment Workshop, Assessment Summary Report.

Pollock background documents

C1. Northeast Fisheries Science Center, 2008. *Pollock in subareas 5 and 6.* pp. 642-657 in: *Assessment of 19 Northeast Groundfish Stocks through 2007 Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008.* Northeast Fisheries Science Center Reference Document 08-15.

C2. Thompson, N., 2009. *Update on status of pollock, including Autumn 2008 NEFSC survey data.* Unpublished memo to Pat Kurkul.

C3. Mayo, R.K., 1998. *Pollock.* pp. 67-69. in: *Status of Fishery Resources off the Northeastern US for 1998.* Northeast Fisheries Science Center.

C4. Northeast Fisheries Science Center, 1993. *Pollock.* pp. 7-38 in: *Report of the 16th Northeast Regional Stock Assessment Workshop (16th SAW): Stock Assessment Review Committee (SARC) Consensus Summary of Assessments.* Northeast Fisheries Science Center Reference Document 93-18.

C5. Mayo, R.K., 2001. *Scotian Shelf/Georges Bank/Gulf of Maine Pollock.* pp. 155-161. in: *Assessment of 19 Northeast Groundfish Stocks through 2000: A Report to the New England Fishery Management Council's Multi-Species Monitoring Committee.* Northeast Fisheries Science Center Reference Document 01-20.

C6. Mayo, R.K., Col, L. & Traver, M., 2005. *Georges Bank/Gulf of Maine Pollock.* pp. 359-371 in: *Assessment of 19 Northeast Groundfish Stocks through 2004: 2005 Groundfish Assessment Review Meeting (2005 GARM), Northeast Fisheries Science Center, Woods Hole, MA, 15-19 August 2005.* Northeast Fisheries Science Center Reference Document 05-13.

C7. NOAA, 1989. *Stock Assessment Information for Pollock, Pollachius virens (L.), in the Scotian Shelf, Georges Bank, and Gulf of Maine Regions.* NOAA Technical Memorandum NMFS-F/NEC-65.

C8. Neilson, J.D., Stobo, W.T. & Perley, P., 2006. Pollock (*Pollachius virens*) stock structure in the Canadian Maritimes inferred from mark-recapture studies. *ICES Journal of Marine Science*, **63**, 749-765.

C9. North East Fisheries Science Center, 2010. *Pollock Data Meeting.* Unpublished background document.

C10. Clay, D., Stobo, W.T., Beck, B. & Hurley, P.C.F., 1989. Growth of juvenile pollock (*Pollachius virens* L.) along the Atlantic coast of Canada with inferences of inshore-offshore movements. *Journal of Northwest Atlantic Fishery Science*, **9**, 37-43.

C11. Chase, P., Brown, R., Politis, P., Sherman, S. & King, J., 2010. *Comparison of surveys.* North East Fisheries Science Center, unpublished background document.

C12. North East Fisheries Science Center, 2008. *Technical Documentation for ASAP Version 2.0.* NOAA Fisheries Toolbox.

C13. Stone, H., Nelson, C., Clark, D. & Cook, A., 2009. *2008 Assessment of Pollock in 4VWX+5.* Canadian Science Advisory Secretariat, Research Document 2009/001.

C14. Nies, T.A., 2010. *Management of the Northeast Multispecies Fishery 1977-2009.* New England Fishery Management Council, Pre-Decisional Information.

Pollock working papers

WP1. Northern Demersal Working Group, 2010. *C. Stock Assessment of Pollock in US Waters for 2010.* 50th Northeast Stock Assessment Workshop, Assessment Report.
WP2. Northern Demersal Working Group, 2010. *C. Pollock Assessment Summary for 2010.* 50th Northeast Stock Assessment Workshop, Assessment Summary Report.

Appendix 2. Copy of the CIE Statement of Work

Statement of Work for John Wheeler

External Independent Peer Review by the Center for Independent Experts

50th Stock Assessment Workshop/ Stock Assessment Review Committee (SAW/SARC) Monkfish, Sea scallop, and Pollock

Scope of Work and CIE Process: The National Marine Fisheries Service's (NMFS) Office of Science and Technology coordinates and manages a contract providing external expertise through the Center for Independent Experts (CIE) to conduct independent peer reviews of NMFS scientific projects. The Statement of Work (SoW) described herein was established by the NMFS Project Contact and Contracting Officer's Technical Representative (COTR), and reviewed by CIE for compliance with their policy for providing independent expertise that can provide impartial and independent peer review without conflicts of interest. CIE reviewers are selected by the CIE Steering Committee and CIE Coordination Team to conduct the independent peer review of NMFS science in compliance the predetermined Terms of Reference (ToRs) of the peer review. Each CIE reviewer is contracted to deliver an independent peer review report to be approved by the CIE Steering Committee and the report is to be formatted with content requirements as specified in **Annex 1**. This SoW describes the work tasks and deliverables of the CIE reviewer for conducting an independent peer review of the following NMFS project. Further information on the CIE process can be obtained from www.ciereviews.org.

Project Description: The purpose of this SARC50 meeting will be to provide an external peer review of benchmark stock assessments for monkfish (also called goosefish, *Lophius americanus*), sea scallop (*Placopecten magellanicus*), and pollock (*Pollachius virens*). Goosefish are piscivorous, and they rest partially buried on soft bottom substrates and attract prey using a modified fin ray that resembles a fishing pole and lure. Sea scallops are relatively large filter-feeding bivalves that rest on the bottom. Pollock are fast swimming, schooling fish. This review determines whether the scientific assessments are adequate to serve as a basis for developing fishery management advice. Results form the scientific basis for fishery management in the northeast region. This meeting satisfies Prioritization criteria 1-3. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**. The SARC Summary Report format is attached as **Annex 4.**

The SARC50 review panel will be composed of three appointed reviewers from the Center of Independent Experts (CIE), a reviewer from the New England Fishery Management Council's Science and Statistics Committee (SSC) and an independent chair from SSC of the New England or Mid-Atlantic Fishery Management Council. The reviewer from the NEFMC SSC is expected to perform duties similar to those described herein for CIE reviewers and on a similar schedule. The SARC panel will write the SARC Summary Report and each CIE and SSC reviewer will write an individual independent review report.

Requirements for CIE Reviewers: Three CIE reviewers shall conduct an impartial and independent peer review in accordance with the SoW and ToRs herein. In general, CIE reviewers for SARC meetings shall have working knowledge and recent experience in the application of modern fishery stock assessment models (e.g., statistical catch-at-age, delay-difference, and traditional VPA). Reviewers should also have experience in evaluating measures of model fit, identification, uncertainty, and forecasting, as well as in development and application of biological reference points. Direct experience with the biology and population dynamics of species on the agenda would be beneficial.

Specifically for the monkfish assessment, reviewers should be familiar with length-based statistical assessment models and methods for experimentally estimating trawl capture efficiency, and survey trawl calibration studies. Familiarity with statistical methods for ageing fish, and monkfish in particular, is desirable.

For the scallop assessment, reviewers should be familiar with methods for assessing invertebrates, especially length-based approaches. Expertise in the implications of spatially distinct harvest patterns for stock dynamics and implications for appropriate harvest rates and biological reference points is essential.

For the pollock assessment, reviewers should be familiar with methods for estimating relative abundance of a schooling fish, statistical catch at age models, and potentially methods for model averaging.

Each CIE reviewer's duties shall not exceed a maximum of 17 days to complete all work tasks of the peer review described herein.

Not covered by the CIE, the SARC chair's duties should not exceed a maximum of 17 days (i.e., several days prior to the meeting for document review; the SARC meeting in Woods Hole; several days following the open meeting for SARC Summary Report preparation).

Location and Date of Peer Review: Each CIE reviewer shall conduct an independent peer review during the panel review meeting scheduled at the Woods Hole Laboratory of the Northeast Fisheries Science Center (NEFSC) in Woods Hole, Massachusetts during June 1-5, 2010.

Charge to SARC panel: The panel is to determine and write down whether each Term of Reference of the SAW (see **Annex 2**) was or was not completed successfully during the SARC meeting. To make this determination, panelists should consider whether the work provides a scientifically credible basis for developing fishery management advice. Criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. Where possible, the chair shall identify or facilitate agreement among the reviewers for each Term of Reference of the SAW.

If the panel rejects any of the current Biological Reference Point (BRP) proxies for B_{MSY} and F_{MSY}, the panel should explain why those particular proxies are not suitable and the panel should recommend suitable alternatives. If such alternatives cannot be identified, then the panel should indicate that the existing BRPs are the best available at this time.

Statement of Tasks:
1. Prior to the meeting
(SARC chair and CIE reviewers)
Review the reports produced by the Working Groups and read background reports.

Each CIE reviewer shall complete the following tasks in accordance with the SoW and Schedule of Milestones and Deliverables herein:

Upon completion of the CIE reviewer selection by the CIE Steering Committee, the CIE shall provide the CIE reviewer information (full name, title, affiliation, country, address, email) to the COTR, who forwards this information to the NMFS Project Contact no later the date specified in the Schedule of Milestones and Deliverables. The CIE is responsible for providing the SoW and ToRs to the CIE reviewers. The NMFS Project Contact is responsible for providing the CIE reviewers with the background documents, reports, foreign national security clearance, and other information concerning pertinent meeting arrangements. The NMFS Project Contact is also responsible for providing the Chair a copy of the SoW in advance of the panel review meeting. Any changes to the SoW or ToRs must be made through the COTR prior to the commencement of the peer review.

Foreign National Security Clearance: When CIE reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for CIE reviewers who are non-US citizens. For this reason, the CIE reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/sponsor.html).

Pre-review Background Documents: Approximately two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE Lead Coordinator on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the SoW scheduled deadlines specified herein. The CIE reviewers shall read all documents in preparation for the peer review.

2. During the Open meeting

Panel Review Meeting: Each CIE reviewer shall conduct the independent peer review in accordance with the SoW and ToRs, and shall not serve in any other role unless specified herein. **Modifications to the SoW and ToRs can not be made during the peer review, and any SoW or ToRs modifications prior to the peer review shall be approved by the COTR and CIE Lead Coordinator.** Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE Lead Coordinator can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

(SARC chair)
Act as chairperson, where duties include control of the meeting, coordination of presentations and discussion, making sure all Terms of Reference of the SAW are reviewed, control of document flow, and facilitation of discussion. For the assessment, review both the Assessment Report and the draft Assessment Summary Report.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of their analyses. It is permissible to discuss the stock assessment and to request additional information if it is needed to clarify or correct an existing analysis and if the information can be produced rather quickly.

(SARC CIE reviewers)
For each stock assessment, participate as a peer reviewer in panel discussions on assessment validity, results, recommendations, and conclusions. From a reviewer's point of view, determine whether each Term of Reference of the SAW was completed successfully. Terms of Reference that are completed successfully are likely to serve as a basis for providing scientific advice to management. If a reviewer considers any existing Biological Reference Point proxy to be inappropriate, the reviewer should try to recommend an alternative, should one exist.

During the question and answer periods, provide appropriate feedback to the assessment scientists on the sufficiency of their analyses. It is permissible to request additional information if it is needed to clarify or correct an existing analysis and if the information can be produced rather quickly.

3. After the Open meeting

(SARC CIE reviewers)

Each CIE reviewer shall prepare an Independent CIE Report (see **Annex 1**). This report should explain whether each Term of Reference of the SAW was or was not completed successfully during the SARC meeting, using the criteria specified above in the "Charge to SARC panel" statement.

If any existing Biological Reference Points (BRP) or their proxies are considered inappropriate, the Independent CIE Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRPs are the best available at this time.

During the meeting, additional questions that were not in the Terms of Reference but that are directly related to the assessments may be raised. Comments on these questions should be included in a separate section at the end of the Independent CIE Report produced by each reviewer.

The Independent CIE Report can also be used to provide greater detail than the SARC Summary Report on specific Terms of Reference or on additional questions raised during the meeting.

(SARC chair)
The SARC chair shall prepare a document summarizing the background of the work to be conducted as part of the SARC process and summarizing whether the process was adequate to complete the Terms of Reference of the SAW. If appropriate, the chair will include suggestions on how to improve the process. This document will constitute the introduction to the SARC Summary Report (see **Annex 4**).

(SARC chair and CIE reviewers)
The SARC Chair and CIE reviewers will prepare the SARC Summary Report. Each CIE reviewer and the chair will discuss whether they hold similar views on each Term of Reference and whether their opinions can be summarized into a single conclusion for all or only for some of the Terms of Reference of the SAW. For terms where a similar view can be reached, the SARC Summary Report will contain a summary of such opinions. In cases where multiple and/or differing views exist on a given Term of Reference, the SARC Summary Report will note that there is no agreement and will specify - in a summary manner – what the different opinions are and the reason(s) for the difference in opinions.

The chair's objective during this Summary Report development process will be to identify or facilitate the finding of an agreement rather than forcing the panel to reach an agreement. The chair will take the lead in editing and completing this report. The chair may express the chair's opinion on each Term of Reference of the SAW, either as part of the group opinion, or as a separate minority opinion.

The SARC Summary Report (please see **Annex 4** for information on contents) should address whether each Term of Reference of the SAW was completed successfully. For each Term of Reference, this report should state why that Term of Reference was or was not completed successfully. The Report should also include recommendations that might improve future assessments.

If any existing Biological Reference Point (BRP) proxies are considered inappropriate, the SARC Summary Report should include recommendations and justification for suitable alternatives. If such alternatives cannot be identified, then the report should indicate that the existing BRP proxies are the best available at this time.

The contents of the draft SARC Summary Report will be approved by the CIE reviewers by the end of the SARC Summary Report development process. The SARC chair will complete all final editorial and formatting changes prior to approval of the contents of the draft SARC Summary Report by the CIE reviewers. The SARC chair will then submit the approved SARC Summary Report to the NEFSC contact (i.e., SAW Chairman).

Contract Deliverables - Independent CIE Peer Review Reports: Each CIE reviewer shall complete an independent peer review report in accordance with the SoW. Each CIE reviewer shall complete the independent peer review according to required format and content as described in Annex 1. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in **Annex 2**.

Other Tasks – Contribution to SARC Summary Report: Each CIE reviewer will assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. CIE reviewers are not required to reach a consensus, and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Specific Tasks for CIE Reviewers: The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the **Schedule of Milestones and Deliverables**.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the panel review meeting in Woods Hole, Massachusetts during June 1-5, 2010, and conduct an independent peer review in accordance with the ToRs (**Annex 2**).
3) No later than 18 June 2010, each CIE reviewer shall submit an independent peer review report addressed to the "Center for Independent Experts," and sent to Mr. Manoj Shivlani, CIE Lead Coordinator, via email to shivlanim@bellsouth.net, and Dr. David Sampson, CIE Regional Coordinator, via email to

david.sampson@oregonstate.edu. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each ToR in **Annex 2**.

Schedule of Milestones and Deliverables: CIE shall complete the tasks and deliverables described in this SoW in accordance with the following schedule.

30 April 2010	CIE sends reviewer contact information to the COTR, who then sends this to the NMFS Project Contact
18 May 2010	NMFS Project Contact will attempt to provide CIE Reviewers the pre-review documents by this date
1-5 June, 2010	Each reviewer participates and conducts an independent peer review during the panel review meeting in Woods Hole, MA
4-5 June 2010	SARC Chair and CIE reviewers work at drafting reports during meeting at Woods Hole, MA, USA
18 June 2010	CIE reviewers submit draft CIE independent peer review reports to the CIE Lead Coordinator and CIE Regional Coordinator
21 June 2010	Draft of SARC Summary Report, reviewed by all CIE reviewers, due to the SARC Chair *
28 June 2010	SARC Chair sends Final SARC Summary Report, approved by CIE reviewers, to NEFSC contact (i.e., SAW Chairman)
2 July 2010	CIE submits CIE independent peer review reports to the COTR
9 July 2010	The COTR distributes the final CIE reports to the NMFS Project Contact and regional Center Director

* The SARC Summary Report will not be submitted, reviewed, or approved by the CIE.

The SAW Chairman will assist the SARC chair prior to, during, and after the meeting in ensuring that documents are distributed in a timely fashion.

NEFSC staff and the SAW Chairman will make the final SARC Summary Report available to the public. Staff and the SAW Chairman will also be responsible for production and publication of the collective Working Group papers, which will serve as a SAW Assessment Report.

Modifications to the Statement of Work: Requests to modify this SoW must be approved by the Contracting Officer at least 15 working days prior to making any permanent substitutions. The Contracting Officer will notify the COTR within 10 working days after receipt of all required information of the decision on substitutions. The COTR can approve changes to the milestone dates, list of pre-review documents, and ToRs within the SoW as long as the role and ability of the CIE reviewers to complete the deliverable in accordance with the SoW is not adversely impacted. The SoW and ToRs shall not be changed once the peer review has begun.

Acceptance of Deliverables: Upon review and acceptance of the CIE independent peer review reports by the CIE Lead Coordinator, Regional Coordinator, and Steering Committee, these reports shall be sent to the COTR for final approval as contract deliverables based on compliance with the SoW and ToRs. As specified in the Schedule of Milestones and Deliverables, the CIE shall send via e-mail the contract deliverables (CIE independent peer review reports) to the COTR (William Michaels, via William.Michaels@noaa.gov).

Applicable Performance Standards: The contract is successfully completed when the COTR provides final approval of the contract deliverables. The acceptance of the contract deliverables shall be based on three performance standards:
(1) each CIE report shall completed with the format and content in accordance with **Annex 1**,
(2) each CIE report shall address each ToR as specified in **Annex 2**,
(3) the CIE reports shall be delivered in a timely manner as specified in the schedule of milestones and deliverables.

Distribution of Approved Deliverables: Upon acceptance by the COTR, the CIE Lead Coordinator shall send via e-mail the final CIE reports in *.PDF format to the COTR. The COTR will distribute the CIE reports to the NMFS Project Contact and Center Director.

Support Personnel:

William Michaels, Contracting Officer's Technical Representative (COTR)
NMFS Office of Science and Technology
1315 East West Hwy, SSMC3, F/ST4, Silver Spring, MD 20910
William.Michaels@noaa.gov Phone: 301-713-2363 ext 136

Manoj Shivlani, CIE Lead Coordinator
Northern Taiga Ventures, Inc.
10600 SW 131st Court, Miami, FL 33186
shivlanim@bellsouth.net Phone: 305-383-4229

Key Personnel:

Dr. James Weinberg, NEFSC Stock Assess. Workshop (SAW) Chair, (NMFS Project Contact)
National Marine Fisheries Service, NOAA
Northeast Fisheries Science Center
166 Water St., Woods Hole, MA 02543
james.weinberg@noaa.gov Phone: 508-495-2352

Dr. Nancy Thompson, NEFSC Science Director

National Marine Fisheries Service, NOAA
Northeast Fisheries Science Center
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Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of whether they accept or reject the work that they reviewed, with an explanation of their decision (strengths, weaknesses of the analyses, etc.).

2. The main body of the reviewer report shall consist of a Background, Description of the Individual Reviewer's Role in the Review Activities, Findings of whether they accept or reject the work that they reviewed, and an explanation of their decisions (strengths, weaknesses of the analyses, etc.) for each ToR, and Conclusions and Recommendations in accordance with the ToRs. For each assessment reviewed, the report should address whether each Term of Reference of the SAW was completed successfully. For each Term of Reference, the Independent Review Report should state why that Term of Reference was or was not completed successfully. To make this determination, the SARC chair and CIE reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice.

   a. Reviewers should describe in their own words the review activities completed during the panel review meeting, including a concise summary of whether they accept or reject the work that they reviewed, and explain their decisions (strengths, weaknesses of the analyses, etc.), conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each ToR even if these were consistent with those of other panelists, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the SARC Summary Report that they feel might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The CIE independent report shall be a stand-alone document for others to understand the proceedings and findings of the meeting, regardless of whether or not others read the SARC Summary Report. The CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer report shall include as separate appendices as follows:

   Appendix 1: Bibliography of materials provided for review
   Appendix 2: A copy of the CIE Statement of Work

Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

ANNEX 2: *Assessment Terms of Reference for SAW/SARC50 (June 2010)*
(file vers.: 12/22/09-c)

A. Monkfish

1. Characterize the commercial catch including landings, effort, LPUE and discards. Describe the uncertainty in these sources of data.

2. Report results of 2009 cooperative monkfish survey and describe sources of uncertainty in the data and results.

3. Characterize other survey data that are being used in the assessment (e.g., regional indices of abundance, recruitment, length data, state surveys). Describe the uncertainty in these sources of data.

4. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and characterize the uncertainty of those estimates.

5. Update or redefine biological reference points (BRPs; estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, and $F_{MSY;}$ and estimates of their uncertainty). Comment on the scientific adequacy of existing and redefined BRPs.

6. Evaluate stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 5).

7. Evaluate monkfish diet composition data and its implications for population level consumption by monkfish.

8. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs).
   d. Provide numerical short-term projections (through 2016). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions to examine important sources of uncertainty in the assessment.
   e. Comment on which projections seem most realistic, taking into consideration uncertainties in the assessment.
   f. Describe this stock's vulnerability to becoming overfished, and how this could affect the choice of ABC.

9. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in recent SARC reviewed assessments and review panel reports. Identify new research recommendations.

B. Sea scallop

1. Characterize the commercial catch including landings, effort, LPUE and discards. Describe the uncertainty in these sources of data.

2. Characterize the survey data that are being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, length data, etc.). Describe the uncertainty in these sources of data. Document the transition between the survey vessels and their calibration. If other survey data are used in the assessment, describe those data as they relate to the current assessment (Exclude consideration of future survey designs and methods).

3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and characterize the uncertainty of those estimates.

4. Update or redefine biological reference points (BRPs; estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, and $F_{MSY;}$ and estimates of their uncertainty). Comment on the scientific adequacy of existing and redefined BRPs.

5. Evaluate stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 4).

6. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs).
   d. Provide numerical short-term projections (through 2014). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions to examine important sources of uncertainty in the assessment.
   e. Comment on which projections seem most realistic, taking into consideration uncertainties in the assessment.
   f. Describe this stock's vulnerability to becoming overfished, and how this could affect the choice of ABC.

7. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in recent SARC reviewed assessments and review panel reports. Identify new research recommendations.

C. Pollock

1. Characterize the commercial and recreational catch including landings, effort, LPUE and discards. Describe the uncertainty in these sources of data, including consideration of stock definition.

2. Characterize the survey data that are being used in the assessment (e.g., regional indices of abundance, recruitment, state surveys, age-length data, etc.). Describe the uncertainty in these sources of data, including consideration of stock definition.

3. Estimate annual fishing mortality, recruitment and stock biomass (both total and spawning stock) for the time series, and characterize the uncertainty of those estimates.

4. Update or redefine biological reference points (BRPs; estimates or proxies for B_{MSY}, $B_{THRESHOLD}$, and $F_{MSY;}$ and estimates of their uncertainty). Comment on the scientific adequacy of existing and redefined BRPs.

5. Evaluate stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 4).

6. Evaluate pollock diet composition data and its implications for population level consumption by pollock.

7. Develop and apply analytical approaches and data that can be used for conducting single and multi-year stock projections and for computing candidate ABCs (Acceptable Biological Catch; see Appendix to the TORs).
    e. Provide numerical short-term projections (through 2017). Each projection should estimate and report annual probabilities of exceeding threshold BRPs for F, and probabilities of falling below threshold BRPs for biomass. In carrying out projections, consider a range of assumptions to examine important sources of uncertainty in the assessment.
    f. Comment on which projections seem most realistic, taking into consideration uncertainties in the assessment.
    g. For a range of candidate ABC scenarios, compute probabilities of rebuilding the stock by 2017.
    h. Describe this stock's vulnerability to becoming overfished, and how this could affect the choice of ABC.

8. Review, evaluate and report on the status of the SARC and Working Group research recommendations listed in recent SARC reviewed assessments and review panel reports. Identify new research recommendations.

Appendix to the SAW TORs: Clarification of Terms used in the SAW/SARC Assessment Terms of Reference

(The text below is from DOC National Standard Guidelines, Federal Register, vol. 74, no. 11, January 16, 2009)

On "Acceptable Biological Catch":

Acceptable biological catch (ABC) is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of [overfishing limit] OFL and any other scientific uncertainty…" *(p. 3208) [In other words, OFL ≥ ABC.]*

ABC for overfished stocks. For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan. *(p. 3209)*

NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. (p. 3180)

ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, [optimal yield] OY does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. (p. 3189)

On "Vulnerability":

"Vulnerability. A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce MSY and to recover if the population is depleted, and susceptibility is the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality)." (p. 3205)

Annex 3: Meeting Agenda (Preliminary)

50th Northeast Regional Stock Assessment Workshop (SAW 50)
Stock Assessment Review Committee (SARC) Meeting

June 1-5, 2010

Stephen H. Clark Conference Room – Northeast Fisheries Science Center
Woods Hole, Massachusetts

This is a Preliminary AGENDA (version: 2 Feb 2010)

TOPIC	PRESENTER(S)	SARC LEADER	RAPPORTEUR

Tuesday, June 1

8:45-9 AM
Opening
Welcome — **James Weinberg**, SAW Chairman
Introduction — **TBD**, SARC Chairman
Agenda
Conduct of Meeting

9-11 Assessment Presentation (A. Monkfish)
TBD **TBD** **TBD**

11-11:15 Break

11:15 -Noon SARC Discussion w/ presenters (A. Monkfish)
TBD, SARC Chairman

Noon – 1:15 Lunch

1:15 – 3:30 Assessment Presentation (B. Sea Scallop)
TBD **TBD** **TBD**

3:30-3:45 Break

3:45-5:30 PM SARC Discussion w/ presenters (B. Sea Scallop)
TBD, SARC Chairman

Wednesday, June 2

8:45-10:45 Assessment Presentation (C. Pollock)
TBD **TBD** **TBD**

10:45-11 Break

11 -Noon SARC Discussion w/ presenters (C. Pollock)
TBD, SARC Chairman

Noon – 1:15 Lunch

1:15 – 3:15 Revisit w/ presenters (A. Monkfish)
TBD, SARC Chairman

3:15-3:30 Break

3:30-5:30 PM Revisit w/ presenters (B. Sea Scallop)
TBD, SARC Chairman

Thursday, June 3

8:45-10:45 Revisit w/ presenters (C. Pollock)
TBD, SARC Chairman
10:45 – 11 Break

11 - Noon Review/edit Assessment Summary Report (A. Monkfish)
TBD, SARC Chairman

Noon – 1:15 Lunch
1:15 – 2:30 cont. Review Assessment Summary Report (A. Monkfish)
TBD, SARC Chairman
2:30 – 2:45 Break
3 – 5:30 PM Review/edit Assessment Summary Report (B. Sea Scallop)
TBD, SARC Chairman

Friday, June 4

9 - 11:30 Review/edit Assessment Summary Report (C. Pollock)
TBD, SARC Chairman
11:30 – 1:00 Lunch
1 – 5:30 PM SARC Report writing. (closed meeting)

Saturday, June 5

9:00 – 5:30 PM SARC Report writing. (closed meeting)

*All times are approximate, and may be changed at the discretion of the SARC chair. The meeting is open to the public, except where noted.

Annex 4: Contents of SARC Summary Report

1. The main body of the report shall consist of an introduction prepared by the SARC chair that will include the background, a review of activities and comments on the appropriateness of the process in reaching the goals of the SARC. Following the introduction, for each assessment reviewed, the report should address whether each Term of Reference of the SAW was completed successfully. For each Term of Reference, the SARC Summary Report should state why that Term of Reference was or was not completed successfully.

To make this determination, the SARC chair and CIE reviewers should consider whether the work provides a scientifically credible basis for developing fishery management advice. Scientific criteria to consider include: whether the data were adequate and used properly, the analyses and models were carried out correctly, and the conclusions are correct/reasonable. If the CIE reviewers and SARC chair do not reach an agreement on a Term of Reference, the report should explain why. It is permissible to express majority as well as minority opinions.

The report may include recommendations on how to improve future assessments.

2. If any existing Biological Reference Point (BRP) proxies are considered inappropriate, include recommendations and justification for alternative proxies. If such alternatives cannot be identified, then indicate that the existing BRPs are the best available at this time.

3. The report shall also include the bibliography of all materials provided during the SAW, and any papers cited in the SARC Summary Report, along with a copy of the CIE Statement of Work.

The report shall also include as a separate appendix the Terms of Reference used for the SAW, including any changes to the Terms of Reference or specific topics/issues directly related to the assessments and requiring Panel advice.

Appendix 3. Panel Membership and Other Pertinent Information

Panel members:

Name	Affiliation	email
Bob O'Boyle	Meeting Chair	betasci@eastlink.ca
Michael Bell	ICIT/Heriot-Watt	m.c.bell@hw.ac.uk
Patrick Sullivan	Cornell	pjs31@cornell.edu
Kurtis Trzcinski	DFO	kurtis.trzcinski@dfo-mpo.gc.ca
John Wheeler	DFO	wheelerj@dfo-mpo.gc.ca

Other meeting attendees:

Name	Affiliation	email
Andrea Toran	NEFSC	andrea.toran@noaa.gov
Maggie Raymond	AFM	
Vidar Wepestad	MDF	
Michele Traver	NEFSC	michele.traver@noaa.gov
Steve Cadrin	NEFSC	steven.cadrin@noaa.gov
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